Time-dependent hybrid simulations of the near-sheath plasma with PIC*

J. Verboncoeur

University of California, Berkeley

A. Kubota, C. Mundy, and T. Rognlien

Lawrence Livermore National Laboratory

Presented at the

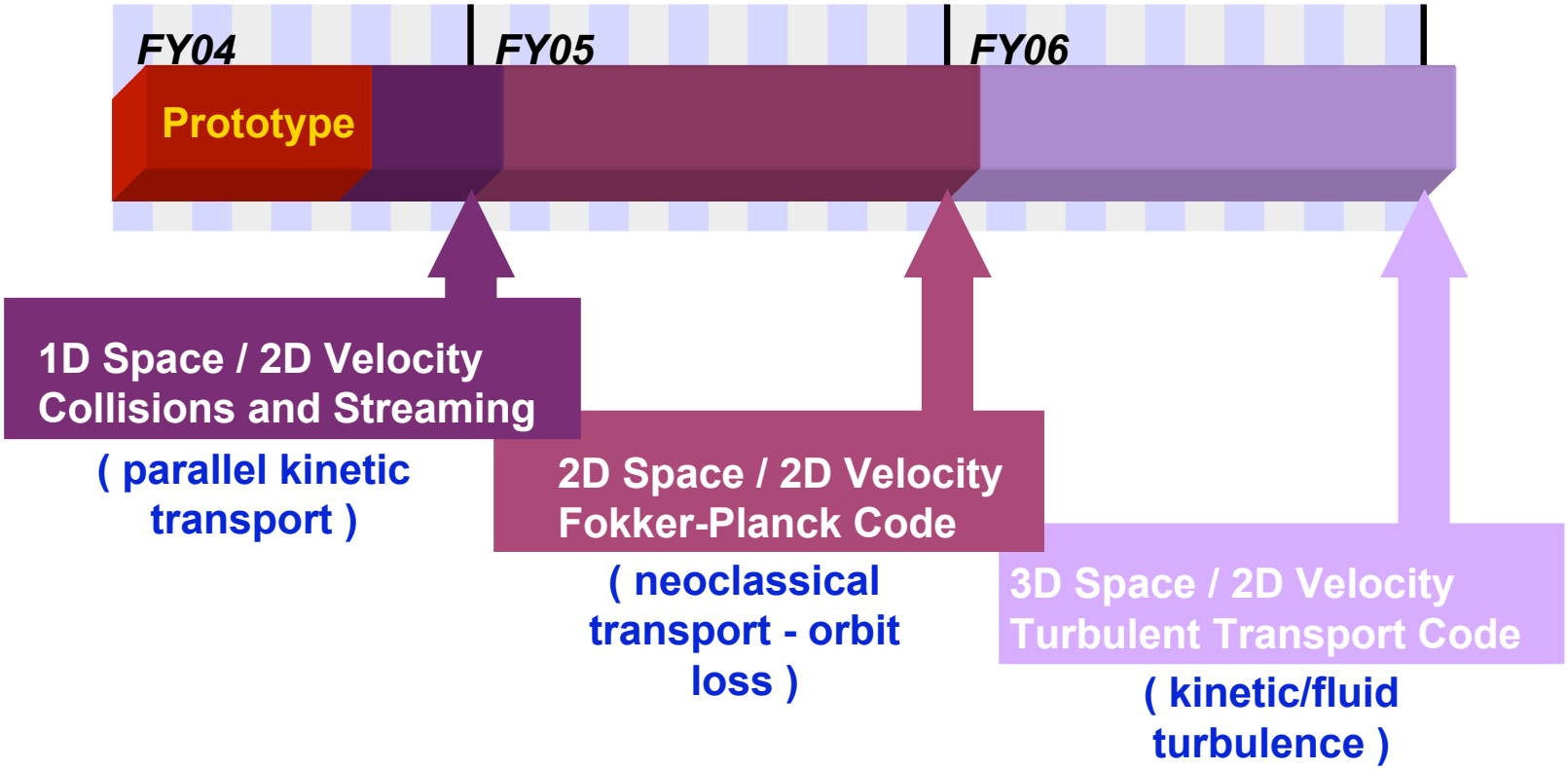
PFC Meeting

Dec. 6-8, 2004

Livermore, CA 94550

*** Work performed under the auspices of U.S. DOE by the Univ. of Calif. Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48 and supported by LDRD SI project.**

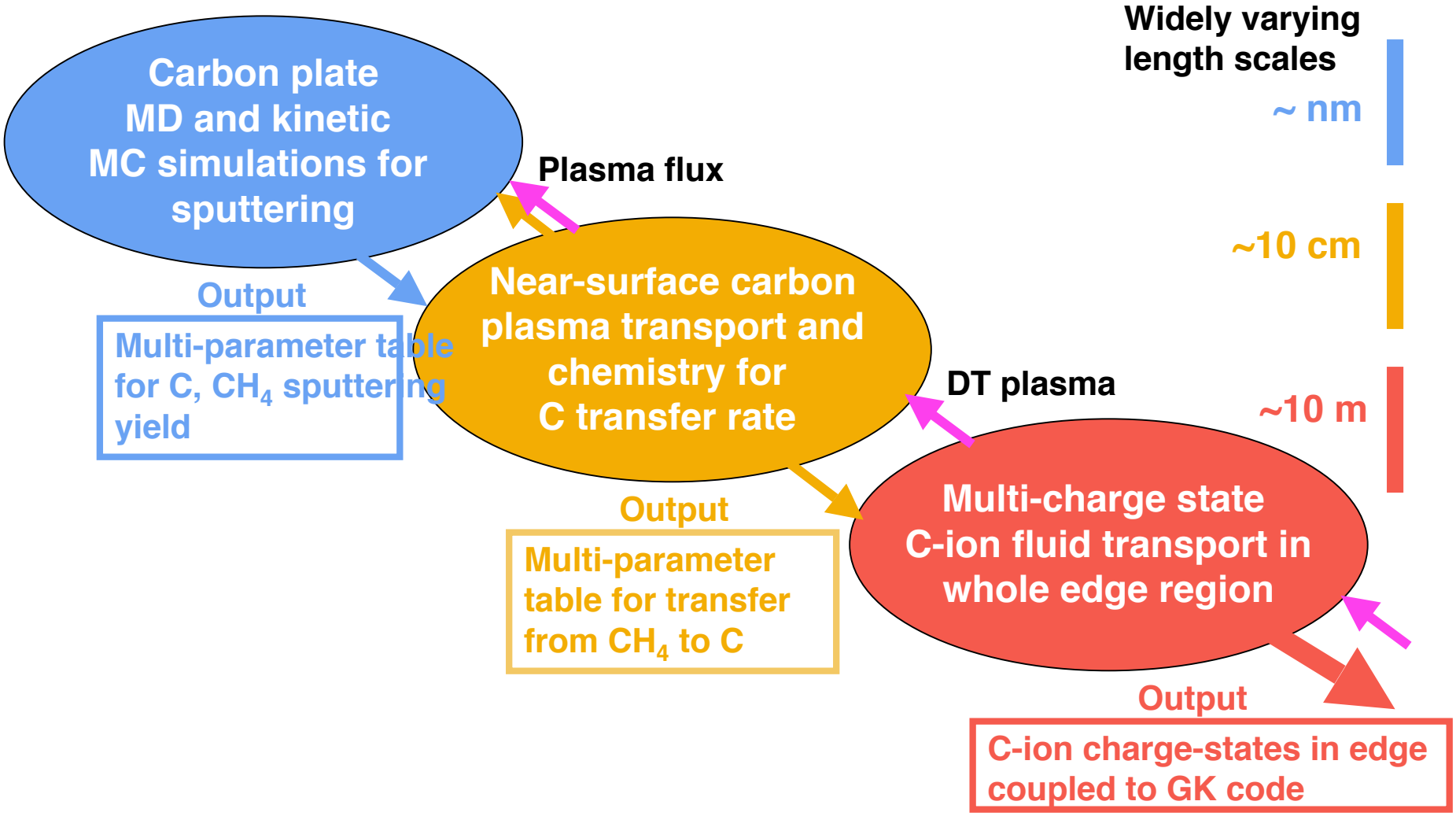
We are developing a whole-edge kinetic code for edge-plasma transport and turbulence



- Initial development being supported by LLNL LDRD exploratory funds
- We seek community input and collaborations

Joint work with surface & plasma groups is providing a model of edge plasma impurities

Impurities in the edge plasma are important for power balance

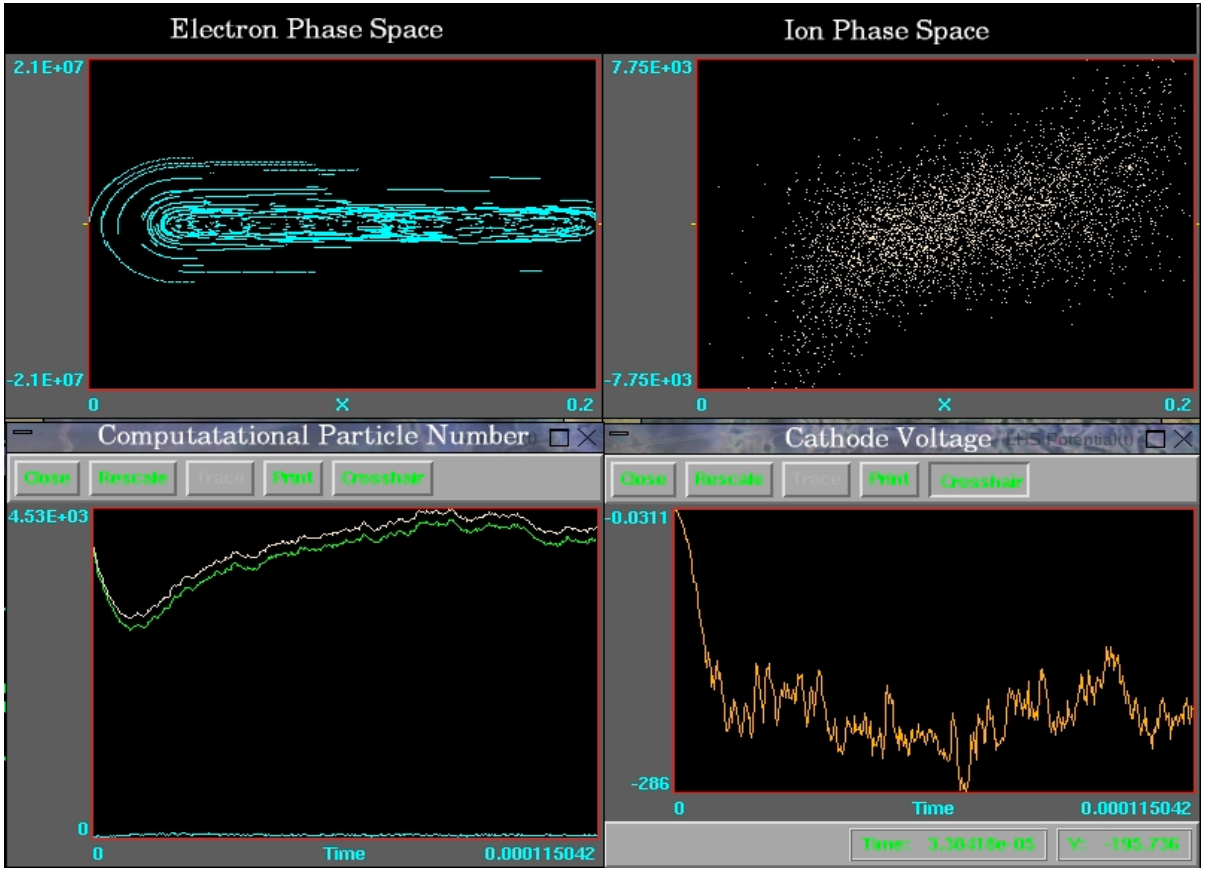


Boltzmann-PIC Hybrid Sheath Model

- PIC ions, Boltzmann-PIC hybrid electrons
- Electrons above specified threshold treated as particles – retains kinetic effects, Monte Carlo collision model
- Electron bulk modeled as inertia less Maxwell-Boltzmann distribution:

$$n(\mathbf{x}) = n_0 \exp\left(-q\phi(\mathbf{x})/T\right)$$

- Can choose arbitrary Boltzmann electron distribution function, f(E), e.g. with cutoff tails.
- Boltzmann species collisions based on f(E)



Current-driven 1D DC discharge runs up to 100 times faster than full PIC model.

Based on Cartwright et al., *Phys. Plasmas* **7**, 3252 (2000).

Summary

- **Fueling of NSTX by strong gas puffing is a plausible solution, but midplane temperatures are suppressed**

- **Detailed 2D coupling between UEDGE and WBC is possible, but some issues still need to be worked out, .e.g,**
  - difference between meshes, i.e., WBC -> flux-surface mesh
  - irregular sputtering coefficient often observed in UEDGE iteration